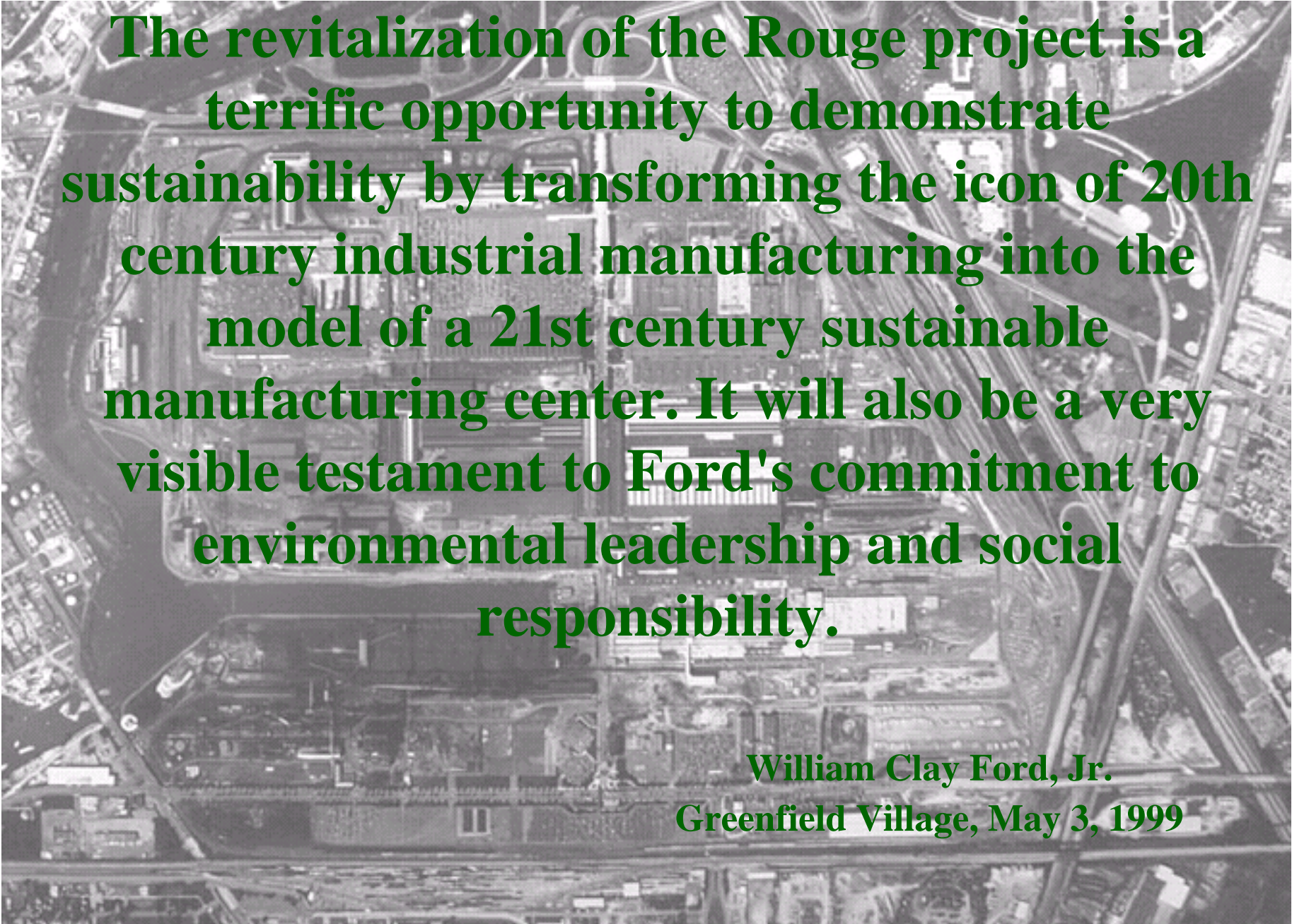


Ford Rouge Heritage Program Sustainability Initiatives



An aerial photograph of a large industrial complex, likely a Ford plant, featuring several large, rectangular buildings, extensive parking areas, and surrounding infrastructure like roads and rail lines. The image is in grayscale with a green tint.

The revitalization of the Rouge project is a terrific opportunity to demonstrate sustainability by transforming the icon of 20th century industrial manufacturing into the model of a 21st century sustainable manufacturing center. It will also be a very visible testament to Ford's commitment to environmental leadership and social responsibility.

**William Clay Ford, Jr.
Greenfield Village, May 3, 1999**

The Next Industrial Revolution Begins

"This is not environmental philanthropy; it is sound business, which, for the first time, balances the business needs of auto manufacturing with ecological and social concerns in the redesign of a brownfield site"



“While most companies would rather move than invest in a 83-year-old site, we view this as an important reinvestment in our employees, our hometown and an American icon of the 20th century.”

William Clay Ford, Jr.

What is Sustainability?

- Sustainability is meeting the needs of the present without compromising future generations
- At Ford, it is a “legacy for the future, built on the past”
- Sustainability is balancing the short and long term effect of design on Social Responsibility, environmental performance and business results

Design for Sustainability

- Design is the first signal of human intent
- Manufacturing must be more than sustainable, it must be **SUSTAINING**
- Sustainability is understanding the short and long term impact of decisions on Ecology, Economy and Equity
- Sustainable Processes are those which promote natural solutions to business by maintaining technical and biological close loops systems

What Does This Have to Do With Building Vehicles?

- Heritage is developing Business Cases supporting Sustainability at the Rouge
- Business Imperatives include proactively addressing future Water and Air Regulations, Urban Heat Affects, alternative energy sources, and attracting the best and brightest people to Ford Manufacturing.
- The 21st Century demands a new vehicle business model using sustainable processes

Ford Rouge Center Sustainability

Economy - Business

- Lean & Flexible
- Quality
- Synchronous Material Flow

Sustainability – Business

Lean and Flexible

- Body – Tooling Flexibility
 - 100% Robotic Welding
 - Generic Architecture on sequence of assembly and shingling
 - Single Geometry Station
 - 3 Platforms - 9 Models
- Paint – Process Flexibility
 - Common Bill of Process
 - Envelope capable of painting Focus through Expedition
 - Common Bill of Material

Sustainability – Business

- Final Assembly – People Flexibility
 - Team Based Production System
 - Adaptive Tooling and adjustable Platform Conveyors
 - Dedicated Team Workspace and Meeting Times
 - 100% DC Tools
 - Web Based Information Technology focused on the Production Teams

Sustainability - Business

Quality

- In Station Process Control in all Departments
 - Detailed Operator Instruction Sheets
 - Customer-Driven Quality Standards
 - Customer Agreements with Suppliers and Workgroups
- Quality Information System
 - Quality Database for each unit
 - Electronic Error Proofing available in each workstation
 - Vehicle Defect Tracking System

Sustainability - Business

Synchronous Material Flow

- Sequencing
 - Predictive Sequence – In line vehicle scheduling
 - Real Time Sequencing – Broadcast
 - Metered Delivery – Daily Quantities of Common Parts
- Material Flow
 - Live Unload of Material
 - Point of Use Docks surround the Factory Floor
 - Dedicated Marketplace adjacent to Production Lines
 - Trailer Staging to synchronize window deliveries
 - Pull System using Vehicle to pull material usage
 - Inbound and Outbound Freight Optimization – Bulls Eye Sourcing

Ford Rouge Center Sustainability

Equity - Social

- Safety
- Outstanding Employee Services
- Team Infrastructure
- Historic Preservation
- Community Service

Sustainability - Social

Safety - Workplace

- Mezzanine separates people from material handling equipment
- Conditioned Air in Body and Final
- Smoke free working environment
- 3 ft. dedicated pedestrian aisle
- No pedestrian traffic in Marketplace
- Entry and exit at Mezzanine Level
- Noise level under 80 decibel
- Body Shop weld smoke ventilation
- Job rotation to improve operator ergonomics and knowledge



Sustainability - Social

Outstanding Employee Services

- Training
 - M- Tech Training Center – Henry Ford College
 - Glass Plant – Production Training Facility
 - Plan for Every Person – Learning Management System
- Personal
 - Family Care – Bill Ford Family Center
 - Personal Services – Laundry, Cleaning, Stylist,...etc.
 - Food Court Style Cafeteria
- Workspace
 - Daylighting, Conditioned Air, and Greening



Sustainability - Social

Team Infrastructure

- Workgroup Activities
 - Small Group Team Leaders – Direct and Indirect areas
 - Workgroup Training to support team skills
 - Rewards and Recognition support team accomplishments
 - Work planning based on job rotation experience
- Workgroup Support
 - Dedicated Team Rooms
 - Planned Weekly Meeting included in Production Schedule
 - Decoupled production lines to support Quality stops
 - Workgroup Information Technology Tools



Sustainability - Social

- Ford Factory Tour presented by The Henry Ford
 - #1 Requested Detroit Area Visitor's Bureau Request
 - Opens Spring, 2004
 - Ford Legacy Theater traces the history of the Rouge
 - Art of Manufacturing is a multi-sensory experience of how an automobile is built
 - Observation Deck 80 feet overlooking the 10.4 acre Green Roof
 - Interactive Factory Tour experience of the DTP Final Assembly Building



Sustainability - Social

- Historic Preservation
 - Restoration of Albert Kahn's historic Glass Plant
 - Gate #4 Bridge – Scene of the “Battle of the Overpass”
 - Gate #4 Plaza with historic Rouge pictures engraved in granite, Icon Product emblems and historic references
 - Powerhouse Memorial remembering 2/1/1999 explosion
 - Future Plans to restore the façade of the Dearborn Assembly Plant – Circa 1932



Sustainability - Social

Community Service

- Environmental Outreach
 - Employee Designed break areas
 - Corporate Wildlife Habitat Council WHC Certification
- Education with "Michigan on the Move"
 - Miller School, Dearborn & Southwest High Schools
- Community Outreach
 - Environmental Education Programs Detroit Area
 - Pre-College Engineering Program - Ford Sponsored & Lead
 - Teaching Materials
 - Accredited by WHC Corporate Lands for Learning



Ford Rouge Center Sustainability

Ecology – Environmental

- Recycling & Waste Reduction
- Sustainable Processes
 - Water: Stormwater
 - Air: Fumes as Fuel
 - Soil: Phytoremediation
- Energy
 - Demonstration Projects: Thermal, Solar

Sustainability - Environmental

Isn't Recycling Sustainable?

- Recycling typically takes high quality components and reuses them in low value/quality materials.
- Sustainable solutions look at design alternatives which effectively use material, renewable energy and human resources
- It minimizes reprocessing at the end of the product cycle to become products again and develops life long customers

Sustainability – Environmental Construction Reuse and Recycle

Objective - Recycle, reclaim, and reuse all building
demolition and construction material waste

Results

- 110,000 tons of concrete and asphalt demolition materials were reused in the new construction
- Approximately 10,000 tons of steel were reused
- Construction material solid waste streams (steel, glass, aluminum...etc. were segregated for recycling.

Sustainability – Environmental Construction Reuse and Recycle

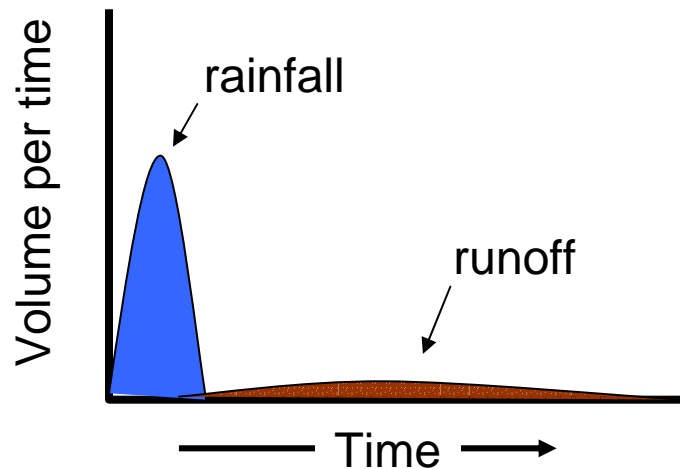
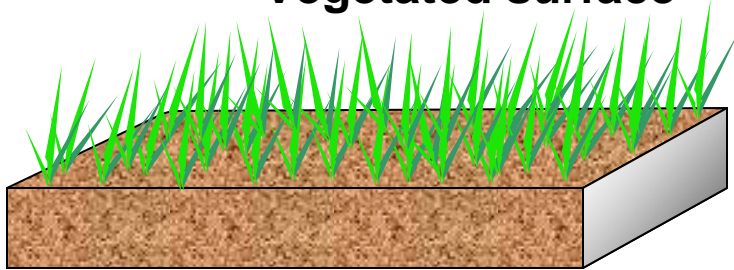
- 95% of Production Parts use returnable containers
- 75% reduction in expendable packaging to less than 15 lbs. per unit
- Suppliers reuse of expendable dunnage being pursued as cost opportunity

Sustainability – Environmental

Engineering Paradigm versus Natural Storm Water Process

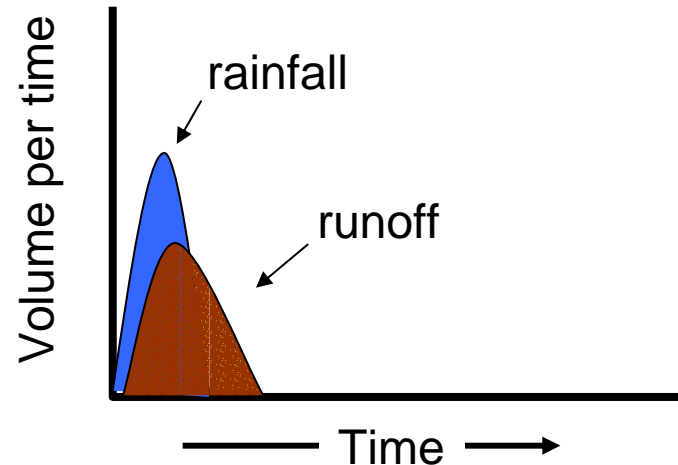
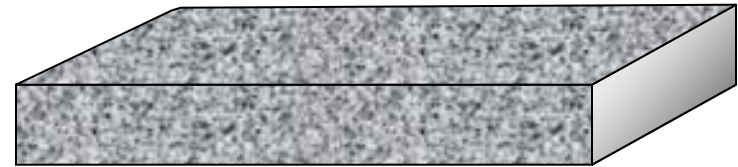
Key Concept – Storm hydrographs

Vegetated surface



Runoff coefficient $< 50\%$
Time of concentration is long

Paved surface



Runoff coefficient $> 85\%$
Time of concentration is very short

Sustainability – Environmental

Phase I Storm Water Design Elements

Treatment wetlands

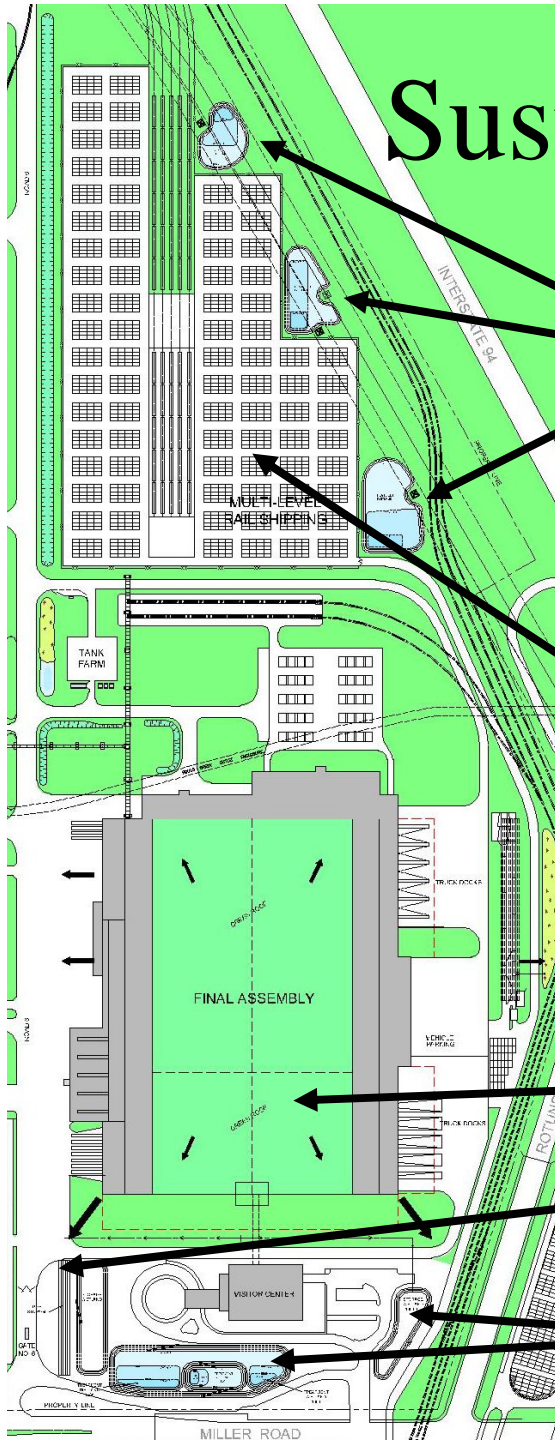
Central storage - porous bed
underlying product lot

Stormwater treatment demonstration area

Vegetated roof

Tubular underground storage

Storage and treatment wetland complex



Sustainability – Environmental

Green Roof Final Assembly Building

- Installed 10.4 acres of habitable roof.
- Constructed of a traditional roofing membrane with drainage layer, soil, root barrier and plants.
- Used varieties of sedum and native plants.
 - Provides sound deadening.
 - Sustains life (birds, butterflies, insects.)
 - Captures and cleanses rainwater before conveyance to stormwater swales.
 - Extends useful life of roof by twice that of conventional roof membranes.
 - Insulating factor. Reduces cooling demand up to 5%, dependant upon moisture level of soil.

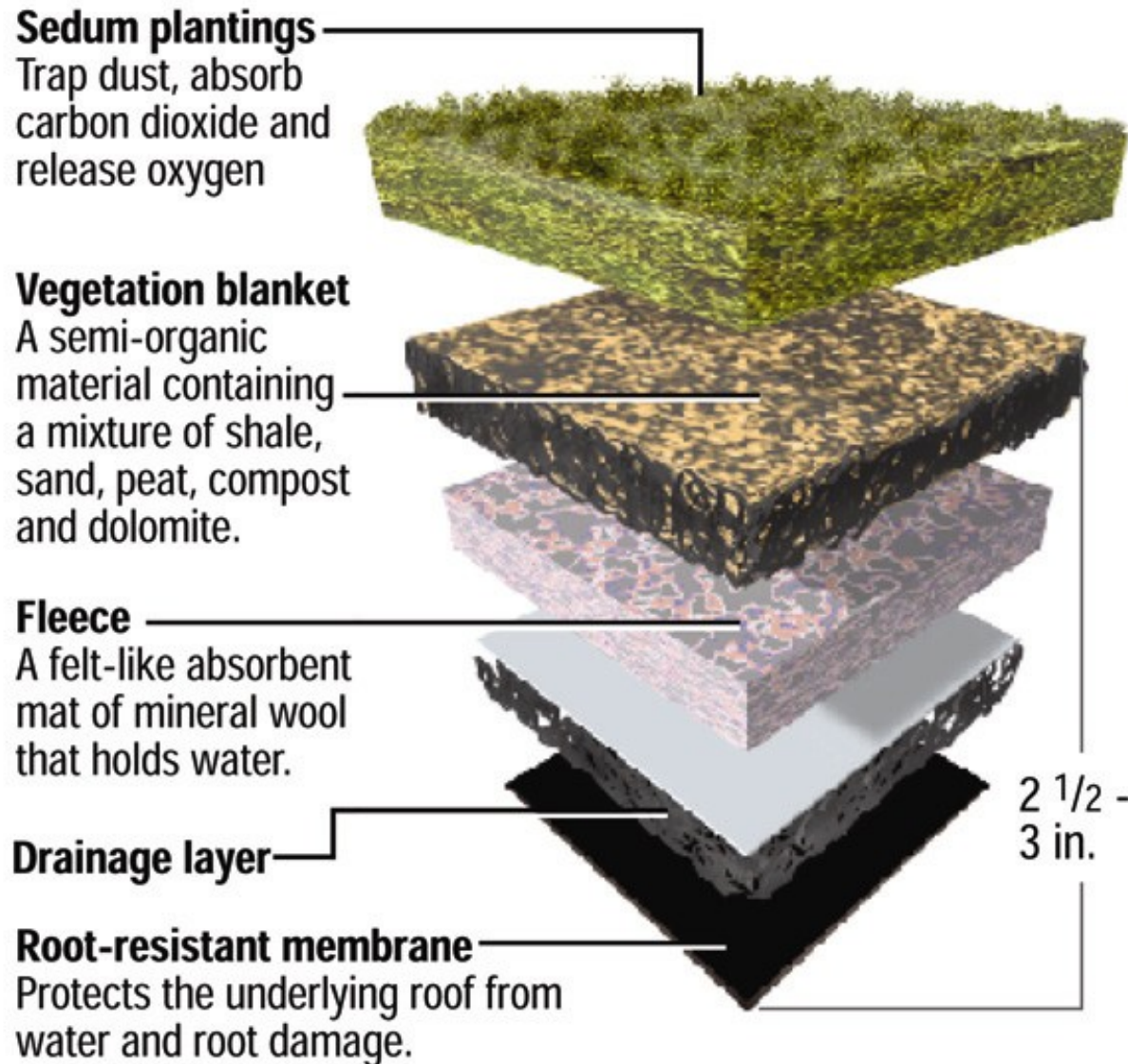


Sedum spurium 'Fulda Glow'



Sedum middendorffianum diffusum

Structure of a typical “Green Roof”

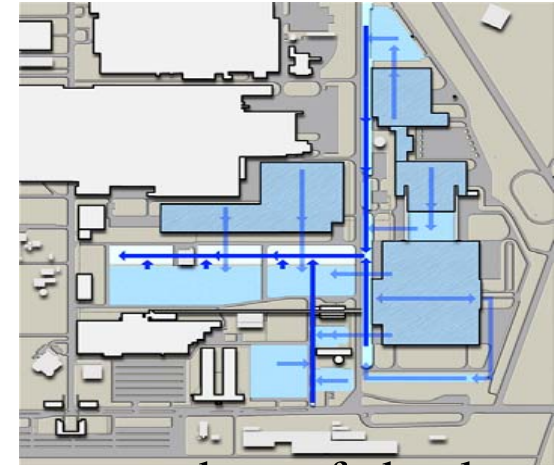


Sustainability - Environmental

Stormwater Management

An advanced groundwater management system of vegetative swales & green roof providing:

- Water quality treatment
- Retention & conveyance of storm water
- Vegetative habitats that sustain wildlife
- Expected to cost less than conventional means to meet expected new federal groundwater management for associated costs for treatment of water prior to coming into site & city storm water
 - Green roof suspends 70% of storm water prior to runoff to site
 - Removes toxic & carbonaceous particulates
 - Provides building cooling thru evaporation & shading
 - Porous paving suspends 25,000 cubic feet of water per acre (installed at Mustang lot, monitoring 2002-2003)
 - Removes trap debris from storm water
 - Keeps pavement cooler



Sustainability - Environmental

Storm Water Management Strategy

(Green Roofs, Habitat Culverts, Porous Paving and Other Actions)

A number of impacts of the total storm water management strategy have been identified including;

- Regulatory savings
- Media coverage
- Government grant potential
- Maintenance savings
- Indigenous habitable space
- Visual appeal to community
- Biophilia impact on employees
- Noise dampening effects
- Evaporative cooling impact

Of these items, the highest impact component is the regulatory compliance requirement.

Sustainability – Environmental

Soil

- Phytoremediation is an innovative technology that utilizes the natural properties of plants in engineered systems to remediate hazardous waste sites.
 - uptake of ground water and contaminants by plants;
 - enhanced microbial activity in the rhizosphere;
 - fate and transport of contaminants in plant root zones;
 - phytotoxicity and revegetation in contaminated soils;
 - transpiration and its effect on ground water flow;
 - fate of contaminants in plants after uptake.



Sustainability – Environmental

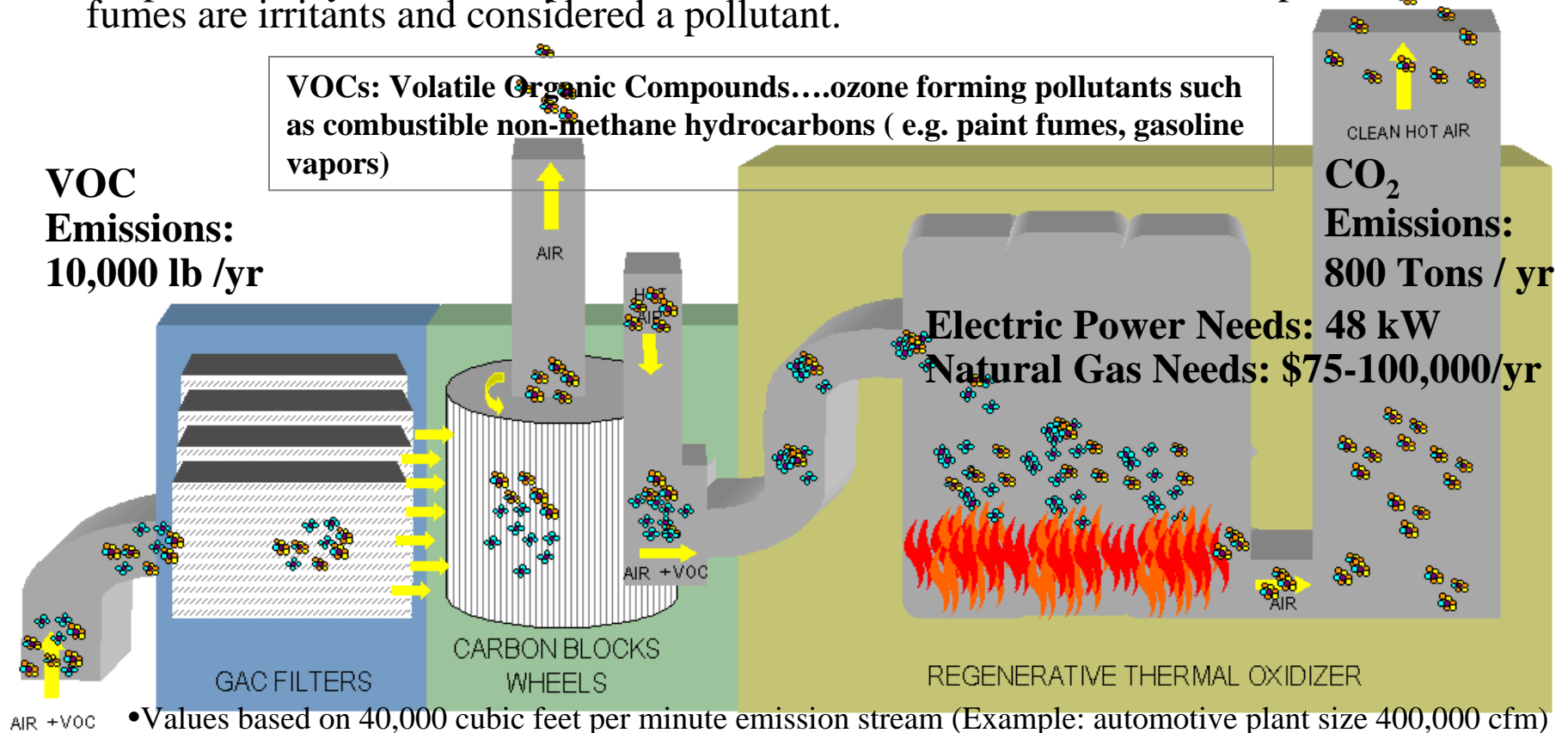
Air: Fumes for Fuel Existing Abatement Technology

- Some of the odor you smell when a car is painted is the solvent drying.

The solvent is a petrochemical and contains hydrocarbons.

Normally the concentration of the hydrocarbons is low and the solvent part of so-called "oil" paints is flammable, but not a good fuel.

Our present practice is to use natural gas burners to burn the solvent so that our paint shops emit only the normal products of combustion - CO₂ and Water vapor. Solvent fumes are irritants and considered a pollutant.

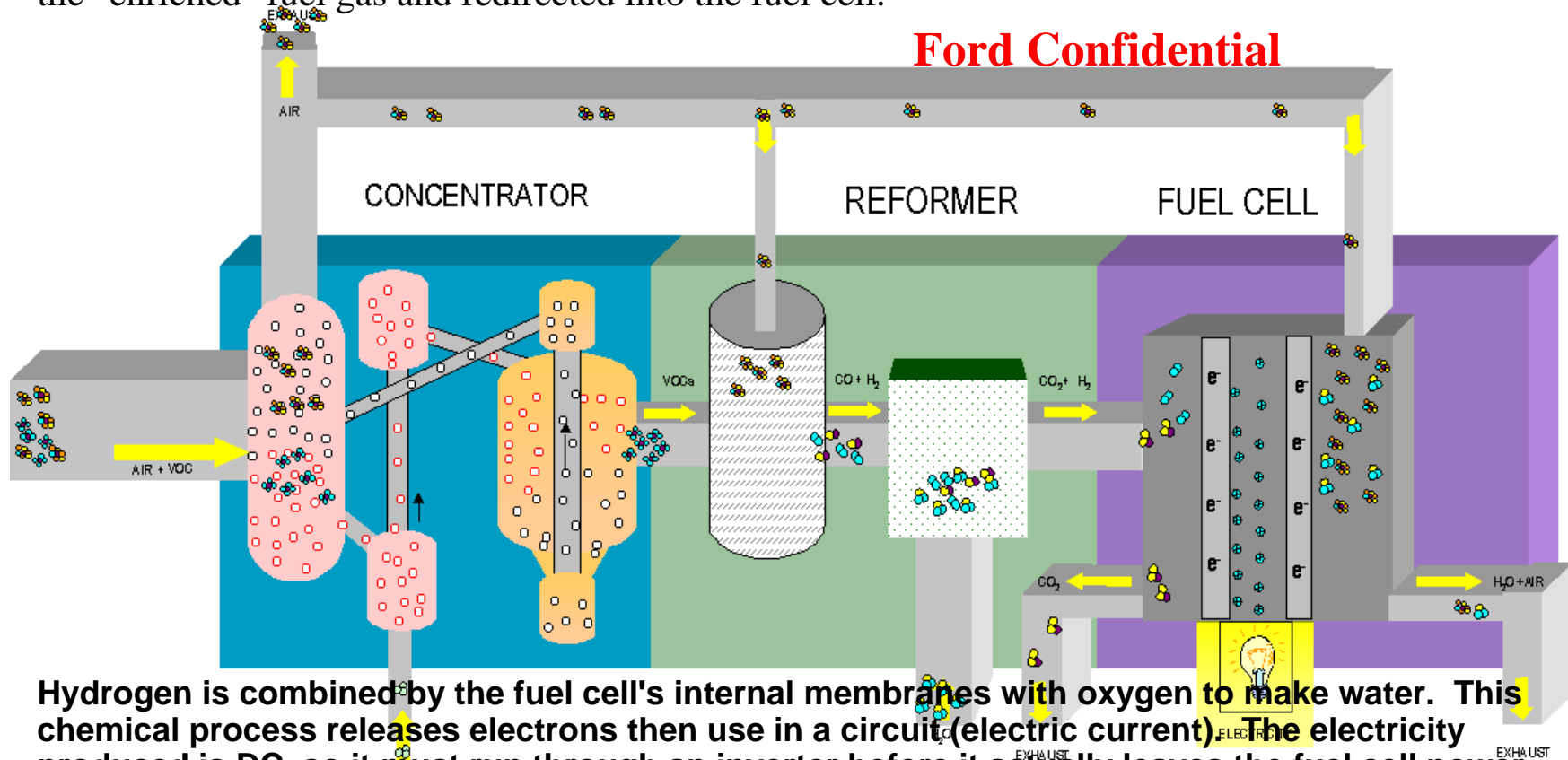


Sustainability - Environmental

Air: Fumes for Fuel Proposed Abatement Technology

Our plan is to develop a concentrator which will pull the fumes out of the general exhaust and make them more like a fuel. Then run that fuel through a "fuel reformer".

A reformer is the front end of a fuel cell power plant. It modifies fuels such as natural gas, propane, or methane by using a catalyst to break up the hydrocarbon chain, increasing the amount of free hydrogen in the resulting gas. It also removes certain impurities like sulfur. The hydrogen is then removed from the "enriched" fuel gas and redirected into the fuel cell.



Hydrogen is combined by the fuel cell's internal membranes with oxygen to make water. This chemical process releases electrons then use in a circuit (electric current). The electricity produced is DC, so it must run through an inverter before it actually leaves the fuel cell power plant as useful electricity.

Sustainability - Energy

Heritage Actual Energy Efficiencies

| IMPROVEMENT | SAVINGS (\$) | CO ₂ AVOIDED (METRIC TONS) |
|---|-----------------|--|
| • “Big Foot” heating and ventilation system | \$ 277,800 | 9,844 |
| • Photo sensors turn off lights when not needed | 46,000 | 826 |
| • High efficiency lamps | 8,000 | 138 |
| • High efficiency lighting design | 30,000 | 550 |
| • Reduced losses from power transformers | 62,000 | 1,124 |
| TOTAL | \$ 423,800 | 12,482 |



Big Foot



Monitor

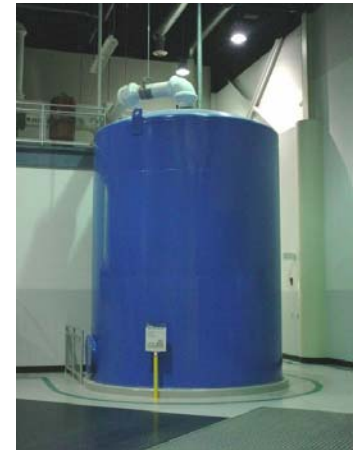
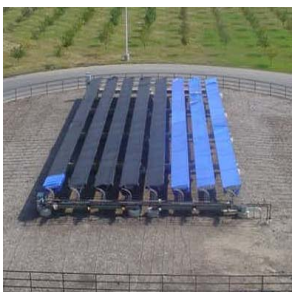


Sustainability – Energy

Demonstration Proposals - Thermal Galvanic, Solar

“Out of the Box” idea sessions with the DOE, Ford, McDonough & architect developed a list feasible ideas, such as:

- Daylighting, monitors, skylights
- Photovoltaics
- Solar Photovoltaics: Panels & Glass
- Thermal Storage Tank
- Internal cisterns for utilizing rainwater for non-potable uses
- Zero Emission Vehicles
- GeoExchange (not cost efficient)
- Wind Power (not cost efficient)



Why? - Sustainable Leadership

- It is good business to become lean & flexible in today's competitive environment.
- The needs of our employees have changed & we are adapting our social infrastructure to support them – to attract the best.
- Environmental stewardship is good business. Solutions must be developed that use waste in technical or biological closed loop systems.

The Bottom Line

- Sustainability supports Ford's goal to be "the World's Leading Consumer Company for Automotive Products and Services".
- Balancing Economy/Business, Equity/Social and Ecology/Environmental supports our future customers and employees.
- The Case for Sustainability must be developed in the broadest business context:
 - to demonstrate Shareholder Value Added
 - enhance Henry Ford's Manufacturing legacy

Heritage 2000 Artists Rendering



Ford Rouge Center Today

